

# A Survey on LIFI Light Fidelity (A Breakthrough in Wireless Communication)

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**Abstract:** LIFI also stated as Light fidelity is a major breakthrough in the field of wireless communication. It is high speed bi-directional and fully networked communication with the help of light instead of conventional radio waves.

LIFI comes under the category of optical wireless communication (OWC). OWC uses visible light, ultra-violet and infra-red rays for communication but LIFI being unique because light used can also be used for illumination.

LIFI was developed to tackle the problem of spectrum crunch and use of light as the medium of communication was the solution to this problem. The light that is used to illuminate our homes, offices, streets etc. can also be used to transfer data and other communication purpose.

LIFI is also associated with higher speeds of transfer than conventional wireless communication technologies and is even secure than WIFI in enclosed spaces. It also comes with additional perks of lesser interference and operation through dense spaces and places where use of radio waves is restricted like hospitals, refineries, nuclear power plants etc.

**Keywords:** Lifi light

## 1. Introduction

The term LIFI was instructed by Prof. Harald Haas and he put forward this revolution in communication at TED Global talk, University of Edinburg. He introduced this idea of “wireless data transfer through every light”, and co-founded a company that develops hardware and all the equipment’s needed for working of LIFI.

LIFI is a breakthrough in the idea of communication by changing the medium from radio waves to other usable options (Visible light, Ultra-violet, Infra-red) which solve many problems associated with spectrum crunch, security etc.

The meaning of connectivity and devices is drastically evolving and the spectrum now has to accommodate more mobiles and connected IOT devices and hence a crunch is being experienced by the serving corporations. With this exponential growth in modern technologies and devices, we need to ensure the fulfillment of future demand of bandwidth and spectrum. This can be achieved by using LIFI (utilizing 10,000 times more spectrum used by radio frequencies) which is helping in exploring unused and unprecedented bandwidth.

LIFI is visible light communication (VLC) system that uses a photo-detector and a signal processing element which

together provide connectivity to internet. The photo-detector is used to receive light and the signal processing element breaks that light stream into streamable data. The emitter encompasses LED’s which are semiconductor light sources. These LED’s are fed with electricity which can be altered and dipped and dimmed at really high speeds making it invisible for normal eyes to register. This rapid change in brightness of the LED is then converted by the receiver(with the help of some signal detection technology) into electrical signal which is converted back into a binary data stream that is recognized as audio, video, or any other data.

LIFI has an upper hand over WIFI (technologies using radio waves for communication) because it uses light waves which cannot penetrate through walls, making it secure for offices, homes, industries and other closed spaces. Also it can serve more users in a dense place with much higher speeds than any other entity. It’s penetration through dense sea water makes it applicable for deep sea explorations. Some of the aspects like limited range (10m) and high cost of proprietary hardware to access LIFI access points are some of the only drawbacks of LIFI so far.

## 2. Working

LIFI has a ceiling-based fixture which is fitted with a lamp driver and LED. The lamp driver is connected to the internet and acknowledges the queries by the users. The lamp driver takes care of modulation of light beam to produce suitable signal, transmitting the beam of light to a photo-receptor. This flickering of LED at ultra-high speeds is not perceived by human eye, making this technology seamless.

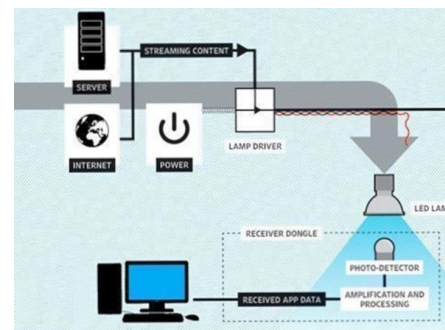


Fig. 1. Working of LIFI

The photo receiver is embedded into a dongle which also has a transmitter to send queries and responses to the server. Then photo receiver converts or demodulates these small changes in the amplitude of light from LED's into electrical signals which is later converted back into data stream and sent to the laptop, mobiles connected to it. Which is known to us as audio, video, and document etc. sort of data.

The Visible light communication (VLC) can be achieved by any light emitting source like filament bulbs, incandescent lamps, LED's etc. but there was a need of a light source whose brightness and amplitude can be altered at higher speeds within Nano seconds and also that this source is to stay for varying voltages, so LED's were chosen. LED's emit light beam which contains streams of photons which can be modulated by alternating current at high speeds to be received by the photo-receptor. LED's being semiconductor devices which means the light can dimmed for usage at dark.

Usage of LED reduces the consumption of power by the apparatus and makes it efficient than others. Since light ray bounce back off rigid surfaces so it's not a strict Line-of-sight technology and totally depends on the signal quality of device.

### 3. Applications

1. *Safer Internet access for hospitals and RF-sensitive places:* Since LIFI uses light waves it can be used at places where electromagnetic interference emerging from cellular and Wi-Fi networks can mess up the sensitive electronic equipment's at hospitals, nuclear plants, refineries.
2. *A more efficient solution for airplane entertainment and Internet:* More and more airplanes have setup to provide internet and entertainment for passengers onboard, and installation of new Wi-Fi setups leads to increase in drag of the plane, thus if we replace all the overhead lights with LIFI we can solve the airplane internet problem.
3. *Data Density:* It serves well within a closed space with

more number of users and provides higher bandwidth and speeds to each of the user connected.

4. *Usage of entire electromagnetic spectrum:* Increasing congestion and number of users will result in spectrum crunch, hence to cope up with this the use of entire electromagnetic spectrum is the only key.
5. *Charging Mobile devices:* LIFI technology can also be used to mobile devices, by incorporating a solar photoreceptor in the display of smartphone, tablet, wristwatch etc.
6. *Industrial Automation:* LIFI is capable of replacing short cables, slip rings, industrial ethernet etc. fulfilling the need of automation and connectivity.

### 4. Conclusion

1. LIFI is not a replacement of the existing WIFI technology, none can outrun or eliminate each other, they can always co-exist together. Closed places and places with dense users can be covered by LIFI and the places where LIFI fails can be covered by WIFI.
2. LIFI is incredibly fast and secure than any other existing technology.
3. LIFI does cover some places with RF (Radio frequency) sensitivity where WIFI cannot be used.
4. Each LIFI system facilitates future technologies like AI (Artificial intelligence), IOT (Internet of things), Automation etc. by providing safer, secure, future-proof, fast infrastructure for them to flourish.

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